

CLAIMS

We claim:

- 1 1. An intelligent label for informing consumers of product
2 quality criteria, said label comprising:
3 message indicators that change color and exhibit a large
4 hysteresis characteristic in response to a temperature change,
5 wherein the message indicators are selected from the group
6 consisting of product quality messages, medical messages,
7 emergency messages, spiritual messages, joke messages, health
8 messages, warning messages, trivia messages, astrological
9 messages, riddle messages, cartoon indicators, and symbol
10 indicators.
- 1 2. The intelligent label according to claim 1, wherein each
2 message indicator comprises liquid crystals that reversibly
3 change color and exhibit a large hysteresis characteristic in
4 response to a temperature change.
- 1 3. The intelligent label according to claim 2, wherein the
2 liquid crystals comprise an electron-supplying organic coloring
3 compound, an electron-accepting compound, and an ester compound
4 for causing the hysteresis characteristic.

1 4. The intelligent label according to claim 3, wherein the
2 electron-supplying organic coloring compound is selected from the
3 group consisting of diaryl phthalides, indolyl phthalides,
4 polyaryl carbinols, leuco auramines, acyl auramines, aryl
5 auramines, rhodamine B lactams, indolines, spiropyrans, and
6 fluorans.

1 5. The intelligent label according to claim 3, wherein the
2 electron-accepting compound is selected from the group consisting
3 of phenolic compounds, metal salts of the phenolic compounds,
4 aromatic carboxylic acids, aliphatic carboxylic acids, metal
5 salts of the acidic phosphoric esters, metal salts of the acidic
6 phosphoric esters, and triazole compounds.

1 6. The intelligent label according to claim 3, wherein the
2 ester compound is selected from the group consisting of alkyl
3 esters, aryl esters and cycloalkyl esters of aromatic carboxylic
4 acid having substituent(s) or not in the aromatic ring, branched
5 alkyl esters, aryl esters, aryl alkyl esters and cycloalkyl
6 esters of aliphatic carboxylic acid, alkyl esters of alicyclic
7 carboxylic acid, and diesters of dicarboxylic acid and
8 glycerides.

1 7. The intelligent label according to claim 1, wherein each
2 message indicator comprises liquid crystals that irreversibly
3 change color and exhibit a large hysteresis characteristic in
4 response to a temperature change.

1 8. The intelligent label according to claim 7, wherein the
2 liquid crystals comprise an electron-supplying organic coloring
3 compound, an electron-accepting compound, and an ester compound
4 for causing the hysteresis characteristic.

1 9. The intelligent label according to claim 8, wherein the
2 electron-supplying organic coloring compound is selected from the
3 group consisting of diaryl phthalides, indolyl phthalides,
4 polyaryl carbinols, leuco auramines, acyl auramines, aryl
5 auramines, rhodamine B lactams, indolines, spiropyrans, and
6 fluorans.

1 10. The intelligent label according to claim 8, wherein the
2 electron-accepting compound is selected from the group consisting
3 of phenolic compounds, metal salts of the phenolic compounds,
4 aromatic carboxylic acids, aliphatic carboxylic acids, metal
5 salts of the acidic phosphoric esters, metal salts of the acidic
6 phosphoric esters, and triazole compounds.

1 11. The intelligent label according to claim 8, wherein the
2 ester compound is selected from the group consisting of alkyl
3 esters, aryl esters and cycloalkyl esters of aromatic carboxylic
4 acid having substituent(s) or not in the aromatic ring, branched
5 alkyl esters, aryl esters, aryl alkyl esters and cycloalkyl
6 esters of aliphatic carboxylic acid, alkyl esters of alicyclic
7 carboxylic acid, and diestels of dicarboxylic acid and
8 glycerides.

1 12. The intelligent label according to claim 1, wherein
2 each message indicator comprises thermochromic/thermochromatic
3 material that reversibly changes color and exhibits a large
4 hysteresis characteristic in response to a temperature change.

1 13. The intelligent label according to claim 12, wherein
2 the thermochromic/thermochromatic material comprises an
3 electron-supplying organic coloring compound, an
4 electron-accepting compound, and an ester compound for causing
5 the hysteresis characteristic.

1 14. The intelligent label according to claim 13, wherein
2 the electron-supplying organic coloring compound is selected from
3 the group consisting of diaryl phthalides, indolyl phthalides,
4 polyaryl carbinols, leuco auramines, acyl auramines, aryl
5 auramines, rhodamine B lactams, indolines, spiropyrans, and
6 fluorans.

1 15. The intelligent label according to claim 13, wherein
2 the electron-accepting compound is selected from the group
3 consisting of phenolic compounds, metal salts of the phenolic
4 compounds, aromatic carboxylic acids, aliphatic carboxylic acids,
5 metal salts of the acidic phosphoric esters, metal salts of the
6 acidic phosphoric esters, and triazole compounds.

1 16. The intelligent label according to claim 13, wherein
2 the ester compound is selected from the group consisting of alkyl
3 esters, aryl esters and cycloalkyl esters of aromatic carboxylic
4 acid having substituent(s) or not in the aromatic ring, branched
5 alkyl esters, aryl esters, aryl alkyl esters and cycloalkyl
6 esters of aliphatic carboxylic acid, alkyl esters of alicyclic
7 carboxylic acid, and diesters of dicarboxylic acid and
8 glycerides.

1 17. The intelligent label according to claim 1, wherein
2 each message indicator comprises thermochromic/thermochromatic
3 material that irreversibly changes color and exhibits a large
4 hysteresis characteristic in response to a temperature change.

1 18. The intelligent label according to claim 17, wherein
2 the therochromic/thermochromatic material comprises an
3 electron-supplying organic coloring compound, an
4 electron-accepting compound, and an ester compound for causing
5 the hysteresis characteristic.

1 19. The intelligent label according to claim 18, wherein
2 the electron-supplying organic coloring compound is selected from
3 the group consisting of diaryl phthalides, indolyl phthalides,
4 polyaryl carbinols, leuco auramines, acyl auramines, aryl
5 auramines, rhodamine B lactams, indolines, spiropyrans, and
6 fluorans.

1 20. The intelligent label according to claim 18, wherein
2 the electron-accepting compound is selected from the group
3 consisting of phenolic compounds, metal salts of the phenolic
4 compounds, aromatic carboxylic acids, aliphatic carboxylic acids,
5 metal salts of the acidic phosphoric esters, metal salts of the
6 acidic phosphoric esters, and triazole compounds.

1 21. The intelligent label according to claim 18, wherein
2 the ester compound is selected from the group consisting of alkyl
3 esters, aryl esters and cycloalkyl esters of aromatic carboxylic
4 acid having substituent(s) or not in the aromatic ring, branched
5 alkyl esters, aryl esters, aryl alkyl esters and cycloalkyl
6 esters of aliphatic carboxylic acid, alkyl esters of alicyclic
7 carboxylic acid, and diestels of dicarboxylic acid and
8 glycerides.